experimenting here, therefore, was to take the rhythm of the heart, or the excitability of the nerve, immediately before screwing up the apparatus, and again immediately after taking it down. I was thus unable to observe the effects of the pressure during the time that it was being actually applied; but as it only took me a quarter of a minute to unship the chamber and turn its contents out on the table, if the 150 atmospheres had exerted any marked influence on the excitability of the tissues, it would probably have been easily detected by this method. Yet neither the heart nor the nerve showed any change after an exposure of five minutes to this great increase of pressure.

VI. "The Influence of Stress and Strain on the Physical Properties of Matter. Part I. Elasticity—*continued.* The Effect of Magnetisation on the Elasticity and the Internal Friction of Metals." By HERBERT TOMLINSON, B.A. Communicated by Professor W. GRYLLS ADAMS, M.A., F.R.S. Received May 18, 1886.

(Abstract.)

The principal object of this investigation was to test the soundness of the view advanced by Professor G. Wiedemann respecting the cause of the internal friction of a torsionally oscillating wire.* According to this view the internal friction is mainly due to permanent rotation to-and-fro of the molecules about their axes; it seemed probable, therefore, that experiments on the effects of magnetising a wire either longitudinally with a helix or circularly by passing a current through it would aid in elucidating the matter.

In the experiments on the effects of longitudinal magnetisation arrangements were made so that the heat generated in the magnetising helix should not reach the wire, whilst the effect of the heat generated in the wire when an electric current was passed through it was eliminated in a manner which is fully described in the paper.

Besides the experiments on the effect of magnetisation on the internal friction and on the torsional elasticity of metals, others were made relating to the longitudinal elasticity of metals. The following are the principal results which have been obtained:—

1. When the deformations produced by the oscillations are small, the internal friction of a torsionally vibrating wire of iron or steel is not affected by sustained longitudinal magnetisation of moderate amount. The internal friction is also not affected by the sustained magnetisation even when the latter is carried to the point of satura-

* "Wiedemann's Annalen," N.F., Bd. vi, p. 485.

tion, provided the magnetising current be, previously to experimenting, reversed a great number of times. When no previous reversals have been made the internal friction is slightly increased by intense magnetisation.

2. When the deformations produced by the oscillations are large the internal friction is very sensibly increased by sustained longitudinal magnetisation of large amount.

3. The torsional elasticity is entirely independent of any sustained longitudinally magnetising stress which may be acting upon an iron or steel wire, provided the deformations produced by the torsional oscillations be small. When the deformations are large, the number of oscillations executed in a given time is very slightly lessened by sustained longitudinal magnetisation of large amount.

4. When the magnetising current is interrupted and, to a greater extent, when it is reversed repeatedly whilst the wire is oscillating, the internal friction is increased, provided the magnetising stress be of moderate amount. The increase of internal friction may become very considerable when the magnetising stress is great.

When the number of interruptions or reversals in a given time of the magnetising current exceeds a certain limit the effect on the internal friction begins to decline.

5. When the deformations produced by the oscillations are small, the torsional elasticity is not affected by either repeatedly interrupted or reversed longitudinal magnetisation even when the magnetising stress is large.

6. There exists a limit of magnetic stress within which no permanent rotation whatever of the molecules is produced. This limit may be widened by previous repeated reversals of a large magnetising stress.

7. The passage of a moderate electric current, whether sustained or interrupted, through a torsionally vibrating wire of iron, steel, or nickel does not affect, except by heating, either the internal friction or the torsional elasticity, provided the deformations produced by the oscillations be small.

8. The effect of longitudinal magnetisation, even when carried to the point of saturation, on the longitudinal oscillation of an iron or steel wire, is *nil*.

9. The passage of an electric current, whether sustained or interrupted, through a longitudinally oscillating wire of iron or steel does not, except by heating, affect the number of oscillations executed in a given time.

10. When the deformations produced by the oscillations do not exceed a certain limit, the internal friction cannot apparently depend upon the *permanent* rotation of the molecules about their axes. When, however, the deformations exceed this limit, the internal

friction becomes very sensibly larger, and does partly, if not mainly, depend upon the permanent rotation to-and-fro of the molecules about their axes. The above-mentioned limit can be widened by allowing the wire to rest after suspension with oscillations at intervals, by annealing, and by repeated heating and cooling.

VII. "Researches in Stellar Photography. 1. In its Relation to the Photometry of the Stars; 2. Its Applicability to Astronomical Measurements of Great Precision." By the Rev. C. PRITCHARD, D.D., F.R.S., Savilian Professor of Astronomy in Oxford. Received May 20, 1886.

(Abstract.)

I. The objects are, first to enquire, by means of accurate measurement, whether there does not exist a definite relation between the area of the disk of a star image impressed on a photographic film and the "photometric magnitude" of that star as determined by instrumental means.

For this purpose, several plates of portions of the Pleiades were taken by varying exposures in the focus of the De la Rue reflector of 13 inches aperture, in the Oxford University Observatory. The diameters of the star disks on these plates were then carefully measured, both with the macro-micrometer and with a double image micrometer, in the same establishment. The result is that the relation sought for is expressed by—

$$D-D'=\delta\{\log M'-\log M\},$$

where D, D′ are the measured diameters of two star disks *on the same plate*, and M, M′ their corresponding "*magnitudes*," as recorded in the "Uranometria Nova Oxonienses."

The mean difference between the observed and computed magnitudes as derived from the foregoing formula, applied to 28 stars all impressed on each of the four plates and ranging from magnitude 3 to magnitude 9·5, is 0·16 magnitude. A few stars (3) here stand out, in all the plates, as was to be expected, arising from the peculiar actinic action of their spectra. Similar anomalies, as is well known, exist in the application of the photometer.

II. In the next section of the enquiry the effect of alteration of the time of exposure on the areas of the star images is referred to. The enquiry is not fully completed, but as far as it extends, it indicates that for stars not very faint, the areas of the disks of the same star on the same plate vary as the square root of the time of exposure.